Short Communication

Susceptibility of Some Tunisian Broad Bean Varieties to Injuries Caused by the Broad Bean Weevil *Bruchus rufimanus* in North Tunisia

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ABSTRACT

Titouhi, F., Amri, M., and Mediouni-Ben Jemâa, J. 2015. Susceptibility of some Tunisian broad bean varieties to injuries caused by the broad bean weevil *Bruchus rufimanus* in North Tunisia. Tunisian Journal of Plant Protection 10: 55-61.

This work aims to investigate for the first time the susceptibility of six Tunisian broad bean varieties: two large seeded varieties i.e. Chahbi and Mamdouh and four small seeded varieties namely Chourouk, Bachaar, Najeh and Badï, to natural field injuries caused by the broad bean weevil *Bruchus rufimanus* in the region of Béja. Results showed that the large seeded varieties appeared to be more infested than field ones. The infestation rates were 37 and 37.5% for Chahbi and Mamdouh, respectively, while for the small seeded varieties, infestations ranged between 29.5 and 6.5% with Badï as the less infested variety. Moreover, seed germination was considerably affected by *B. rufimanus.* Significant differences were observed between infested and non-infested seeds for all varieties. The highest germination reduction was obtained with Mamdouh variety with a rate of 32.98% whereas the lowest value was achieved with Chourouk variety (10.2%). In addition, results indicated that *B. rufimanus* larvae feedings produced significant loss in broad bean seeds weight for all studied varieties. The highest weight loss was observed for small seeded varieties Najeh and Bachaar with weight reduction of 9.67 and 9.37%, respectively.

Keywords: Broad bean, *Bruchus rufimanus*, germination, infestation, varieties

Broad beans or faba beans (*Vicia faba*) are widely cultivated and extensively grown indifferent parts of the world, particularly, in Mediterranean region and North Africa (5, 10, 11, 16). They are the major food legume crops grown in Tunisia (15, 21, 23). But, it was reported that broad bean is attacked by serious pests affecting both its quality and quantity (9). In the Mediterranean region, *V. faba* is attacked by a number of insect pests which often cause extensive damages (25).

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The broad bean weevil *Bruchus rufimanus* (Coleoptera, Bruchidae) is anunivoltine species that starts its infestation on broad bean pods in the field. After harvest, the infested seeds were transmitted to stores where development of beetles is completed (2, 7). Additionally, it was pointed out that since larvae of this pest undergo the entire developmental cycle inside the seeds, they cause significant losses of seed weight and decrease sowing and fodder value of the seeds (14). Furthermore, injured seeds are more easily inhabited by fungi (1, 6). In Tunisia, *B. rufimanus* is an important pest on broad bean in the Utique region where infestation reached more than 80% of broad bean fields (22). This paper reported a first study on the susceptibility of some Tunisian broad bean varieties namely Chahbi and Mamdouh (*V. faba* var. *major*) and Bachar, Badï, Chourouk and Najeh (*V. faba* var. *minor*) to injuries caused by the broad bean weevil *B. rufimanus* in the region of Béja. Effects of *B. rufimanus* on (i) infestation at harvest, (ii) germination rate and (iii) weight loss of *V. faba* seeds were investigated for all varieties.

Trials were conducted in the Research Experimental Station of the *Centre Régional des Recherches en Grandes Cultures à Béja* (36° 43' 30" N; 9° 10' 55" E). Each experimental field occupied an area of 0.12 ha. Sowing was done in December 2013 and no fertilizer or other chemical treatments were applied. The experimental design was a complete randomized block with three replications (Fig. 1). Each variety was sown in rows 4 m long, with 0.5 m inter-row spacing. Respectively, 35 and 50 seeds were sown at equidistant intervals in each row for large seeded broad bean varieties (Chahbi and Mamdouh) and small seeded varieties (Chourouk, Bachaar, Najeh and Badï). To determine the seed infestation rate at harvesting, three replications of 1000 seeds were randomly selected from each plot (500 seeds per row). Each seed was checked for *B. rufimanus* infestation. The percentage of damaged seeds was estimated according to Gusmão *et al.* method (12) and the number of larvae/seed and adults/seed was counted.

The germination was tested on infested seeds. Each essay consisted of 50 seeds repeated 4 times, covered with water moistened cotton. A control trial using no infested seeds was performed with 4 replications (50 seeds each). After 7 days, the germinated seeds in both control and infested seeds were counted. Germination rate was evaluated according to the Gusmão *et al.* method (12). In order to assess the reduction in seed's weight caused by *B. rufimanus* larvae, 50 seeds from each variety with four replications were weighted at harvest and 90 days after the beginning of the tests (duration of postharvest developmental cycle). The loss of weight was determined (4).

Results shown in Fig. 1 indicated that the weevil caused significant infestation to broad bean seeds. The respective infestation rates were 37 and 37.5% for Chahbi and Mamdouh while for varieties Chourouk, Bachaar, Najeh, and Badï, infestations were 29.5, 25, 24 and 6.5%, respectively. Results revealed that broad seeded varieties were more infested compared to small seeded varieties and that Badï is the less infested variety.

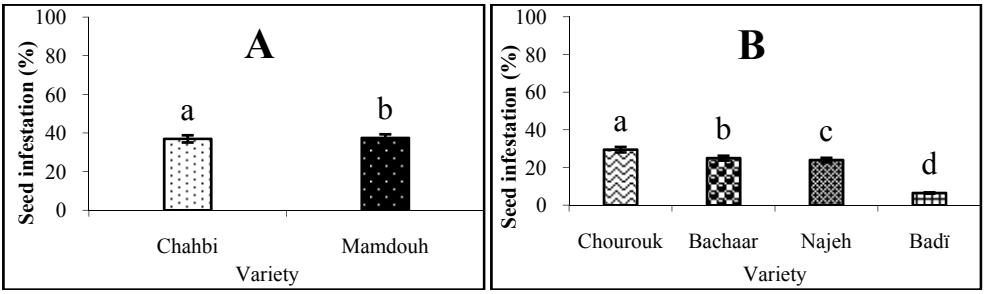

Fig.1. Infestation rates of large seeded broad bean varieties (A) and small seeded varieties (B) at the harvest. Varieties affected by the same letter are not statistically different according to Duncan's multiple range test at $P < 0.05$.

Results related to the determination of *B. rufimanus* effects on germination were reported in Table 1. Significant differences were observed between infested and non-infested seeds for each variety. Large seeded broad bean varieties presented close infestation and germination reduction rates with respectively 69.3 and 32.6% for Chahbi and 65 and 32.98% for Mamdouh. Regarding small seeded varieties, the highest germination reduction was observed for Bachaar with a reduction rate of 26.76% while the lowest germination reduction was recorded for Chourouk with a value of 10.2%. Results showed that *B. rufimanus* effects on seed germination reduction were more remarkable on large seeded varieties than on small seeded ones.

Table 1. Effects of *Bruchus rufimanus* on the germination rate (mean ± SE) of the varieties of broad beans

Broad bean type	Broad bean variety	Infested seeds (%)	Non-infested seeds (%)	Reduction rate (%)
Vicia faba* var. *major	Chahbi	31 ± 5.77 baf (69.33)	46 ± 1.41 abc (92)	32.6
	Mamdouh	32.5 ± 1 bbe (65)	48.5 ± 1.41 aab (97)	32.98
Vicia faba* var. *minor	Chourouk	44 ± 4.32 baa (88)	49 ± 0.81 aba (98)	10.2
	Bachaar	36.25 ± 3.33 bbd (72.5)	49.5 ± 1.95 aba (99)	26.76
	Najeh	43.75 ± 0.95 bab (87.5)	50 ± 0.00 aba (100)	12.5
	Badï	38±1.41 bbc (76)	45.5±0.57 aad (91)	16.48

* Columns followed by the same letter are not statistically different according to Duncan's multiple range test at $P < 0.05$

Table 2 reported results of *B. rufimanus* effects on weight loss of broad beans. Results indicated significant loss in weight of broad bean seeds. All varieties exhibited weight loss of their seeds. The highest weight loss was obtained with Najeh and Bachaar varieties. The lowest loss was observed with large seeded varieties Chahbi and Mamdouh. For both broad bean types and for all varieties, statistical analysis showed significant differences between all varieties (Table 2).

Table 2. Effects of *Bruchus rufimanus* on the weight (mean ± SE) (g) of *Vicia faba* var. *major* and *V. faba* var. *minor* varieties

Broad bean type	Broad bean variety	Infested seeds (%)	Non-infested seeds (%)	Reduction rate (%)
Vicia faba* var. *major	Chahbi	48 ± 1.41 bbc	51.8 ± 0.11 abc	7.33
	Mamdouh	51 ± 0 bac	55 ± 0.11 aac	7.27
Vicia faba* var. *minor	Chourouk	32 ± 0.81 baa	35 ± 0.81 aab	8.57
	Bachaar	29 ± 0.81 bba	32 ± 1.63 aab	9.37
	Najeh	28 ± 1.41 bba	31 ± 0.81 aab	9.67
	Badï	26 ± 0 bba	28 ± 1.41 aba	7.14

* Columns followed by the same letter are not statistically different according to Duncan's multiple range test at $P < 0.05$

Overall results of this study showed clearly that the broad been weevil *B. rufimanus* is a serious pest of *V. faba* in north Tunisia. As reported in this paper, important infestation rates, reduction of germination faculty and visible decrease of the seeds' weight had been caused by this pest on both large seeded and small seeded broad bean fields in north of Tunisia. Previous work indicated that *B. rufimanus* is among the most important insect pests of *V. faba* in Tunisia (8, 22, 25). Similar work conduced in neighboring countries showed that in Algeria and Morocco, *B. rufimanus* is a serious pest of broad beans leading to considerable damage on seeds (3, 4, 13, 19). Broad bean weevil is also a serious pest in Europe damaging broad bean seeds and decreasing their commercial value (17). Results showed also that large seeded varieties appeared to be more infested than small seeded ones. This confirmed that *B. rufimanus* adults have a high activity on the large seeded varieties than the small ones (20). On the other hand, seed germination was considerably affected by *B. rufimanus* infestations. Significant differences were observed between infested and non-infested seeds for all varieties and when comparing the two types of broad beans

(*V. faba* var. *major* and *V. faba* var. *minor*). Additionally, results indicated that *B. rufimanus* larvae feedings produced significant loss in broad bean seeds weight for all studied varieties; the same results were previously proved (4, 18). Further work is required in order to investigate the biological life cycle and to bring out appropriate control management strategies to reduce its impact on broad beans both in fields and during storage.

RESUME

Titouhi F., Amri M. et Mediouni-Ben Jemâa J. 2015. Sensibilité de quelques variétés tunisiennes de fève aux attaques causées par la bruche *Bruchus rufimanus* au nord de la Tunisie. Tunisian Journal of Plant Protection 10: 55-61.

Ce travail a pour objectif d'étudier, pour la première fois, la sensibilité de six variétés tunisiennes de fève (*Vicia faba*); deux variétés de fève (*Vicia faba* var. *major*) à savoir Chahbi et Mamdouh et quatre variétés de fèverole (*Vicia faba* var. *minor*) à savoir Chourouk, Bachaar, Najeh et Badï, aux attaques naturelles causées par la bruche de la fève *Bruchus rufimanus* dans la région de Béja. Les résultats ont montré que les variétés de fève sont plus infestées que celles de féverole. Les pourcentages d'infestation respectifs étaient de 37% et 35,5% pour Chahbi et Mamdouh contre une infestation allant de 6,5% à 29,5% enregistrée chez les variétés de féverole avec un minimum observé chez la variété Badï. En outre, la germination des graines a été significativement affectée par *B. rufimanus*. Des différences significatives ont été observées entre les graines infestées et non infestées pour toutes les variétés testées. La plus importante réduction de la germination a été enregistrée chez la variété Mamdouh (32,98%) contre un minimum enregistré chez la variété Chourouk (10,2%). En outre, les résultats ont indiqué que les prises de nourriture des larves de *B. rufimanus* ont induit des pertes significatives du poids des graines de toutes les variétés étudiées. Les pertes les plus élevées ont été observées sur les variétés de fèverole Najeh et Bachaar avec des réductions respectives de 9,67 et 9,37%.

Mots clés: *Bruchus rufimanus*, fève, germination, infestation, variétés

ملخص

تيتوحي، فاتن ومعز عمري وجودة مديوني-بن جماعة. 2015. حساسية بعض الأصناف التونسية للفول للأضرار الناتجة عن سوسة الفول *Bruchus rufimanus* في شمال البلاد التونسية.

Tunisian Journal of Plant Protection 10: 55-61.

يهدف هذا العمل إلى دراسة لأول مرة تأثير إصابة الفول بالسوسة *Bruchus rufimanus* على ستة أصناف تونسية من الفول، صنفان من الفول العادي (*Vicia faba* var. *major*) هما شهبي وممدوح وأربع أصناف من الفول المصري أو الصغير (*Vicia faba* var. *minor*) هي شروق وبشار ونجاح وبديع، في جهة باجة. أثبتت النتائج أن أصناف الفول كانت أكثر إصابة من أصناف الفول المصري، حيث سجلت نسبة 37% على الشهبي و35.5%على ممدوح، بينما تراوحت نسب الإصابة ما بين 6.5 و 29.5 % على أصناف الفول المصري، مع تسجيل أقل نسبة على صنف بديع. من جانب آخر، تبين أن نسب إنبات البذور تقلصت تحت تأثير إصابات *B. rufimanus* بصفة هامة مقارنة بالبذور السليمة لجميع الأصناف المدروسة. وسجلت أعلى نسبة تقلص لإنبات البذور لدى صنف ممدوح (32.98%) مقابل أدنى نسبة تقلص لصنف شروق (10.2 %). إضافة إلى ذلك، أشارت النتائج إلى أن تغذية يرقات *B. rufimanus* سبب انخفاض هام في وزن بذور جميع الأصناف، وبلغت أكبر نسب نقصان في الوزن عند الفول المصري حيث كانت نسب انخفاض الوزن لصنفي نجاح وبشار 9.7 و9.4%، على التوالي.

كلما ت مفتاحية: إصابة، أصناف، إنبات، فول، *Bruchus rufimanus*

LITERATURE CITED

1. Adamczewski, K., Ciesielski, F., Jańczak, C., Mrówczyński, M., Praczyk, T., and Wachowiak, H. 1992. Dobórpestycydów w chemicznejochroniebobiku. Materiały 32. Sesji Nauk. Inst. Ochr. Roślin, cz.1: 53-63.
2. Boughdad, A., Louge, A., and Loug, G. 1997. Life cycle of *Bruchus rufimanus* Boh. (Coleoptera: Bruchidae) on *Vicia faba* L/var. *minor* L. (Leguminosae) in Marocco. Pages 793-801. In: Proceedings of the 3ème Conférence Internationale sur les Ravageurs en Agriculture, 6-8 Janvier 1997, Le Corum, Montpellier, France.
3. Boughdad, A. 1994. Statut de nuisibilité et écologie des populations de *Bruchus rufimanus* Boheman, 1833 sur *Vicia faba* au Maroc. Thèse de doctorat en Sciences Biologiques Fondamentales et Appliquées, Paris, France, 182 pp.
4. Boughdad, A. 1996. *Bruchus rufimanus*, insecte ravageur des graines de *Vicia faba* L. au Maroc. Pages 179-184. In: Rehabilitation of faba bean. Ed. Actes.
5. Chillo, S., Laverse, J., Falcone, P.M., and Del Nobile, M.A. 2008. Quality of spaghetti in base amaranth us whole meal flour added with quinoa, broad bean and chick pea. J. Food Eng. 84: 101-107.
6. Chodulska, L. 1985. Straty gospodarcze spowodowane przez strąkowca (Coleoptera: Bruchidae). Biul. Hod. Rośl. I Nas. 3: 10-11.
7. Darquenne, J.E., El-Shazly, E.A., Tran, B., and Huignard, J. 1993. Intensity of the reproductive diapauses in a strain of *Bruchus rufimanus* Boh. (Coleoptera: Bruchidae) originating from Meekness region of Morocco. Acta-Oecoloica 14: 847-856.
8. Diekmann, M. 1982. Survey on pests and diseases of faba beans (*Vicia faba*) in Egypt, Morocco and Tunisia. Fabis Newsletter 4: 44-45.
9. Ebadah, I.M.A., Mahmoud, Y.A., and Moawad, S.S. 2006. Susceptibility of some faba bean cultivars to field infestation with some insect pests. Res. J. Agr. Biol. Sci. 2: 537-540.
10. Fortass, M. and Bos, L. 1991.Survey of faba bean (*Vicia faba* L.) for viruses in Morocco. Neth. J. Plant Pathol. 97: 369-380.
11. Gordillo, E.D.M. 1991. Una alternative para el secano, Ediciones Mundi-Prensa, Madrid, Spain, 325 pp.
12. Gusmão, N.M.S., Oliveira, J.V., Navarro, D.M., do A.F., Dutra, K.A., Silva, W.A., and Wanderley, M.J.A. 2013. Contact and fumigant toxicity and repellency of *Eucalyptus citriodora* Hook., *Eucalyptus staigeriana* F., *Cymbopogon winterianus* Jowitt and *Foeniculum vulgare* Mill. essential oils in the management of *Callosobruchus maculatus* (FABR.) (Coleoptera: Chrysomelidae Bruchinae). J. Stored Prod. Res. 54: 41-47.
13. Hamani-Aoudjit, S. 2014. Bioécologie et diapause reproductrice de la bruche de la fève *Bruchus rufimanus* dans deux parcelles de fève et fèverole dans la région de Haizer (Bouira). Mémoire de Mastère en Science Biologiques. Faculté des Sciences Biologiques et Sciences Agronomiques, Université de Tizi-Ouzou, Tizi-Ouzou, Algeria, 104 pp.
14. Kaniuczak, Z. 2004. Seed damage of field bean (*Vicia faba* L. var. *minor* Harz.) caused by broad bean weevil (*Bruchus rufimanus* BOH). (Coleoptera: Bruchidae). J. Plant Prot. Res. 44: 125-130.
15. Kharrat, M., Ben Salah, H., and Halila, H.M. 1991. Faba bean status and prospects in Tunisia. In: Present status and future prospects of faba bean production and improvement in the Mediterranean countries, Cubero J.I & Saxena M.C. (ed), Zaragoza, CIHEAM, 1991. Options Méditerranéennes: Série A. Séminaires Méditerranéens 10: 169-172.
16. Lebbal, S. 2010. Contribution à l'étude de la résistance naturelle de la fève au puceron noir de la luzerne *Aphis craccivora* (Homoptera: Aphididae). Mémoire de Mastère en Science Biologiques. Faculté des Sciences. Université El-Hadj Lakhdar, Batna, Algeria, 75 pp.
17. Leppik, E., Pinier, C., and Frerot, B. 2014. Paysage chimique d'une agrobiocénose: un exemple la fèverole et son ravageur specialiste *Bruchus rufimanus*. Pages 67-77. In Proceedings of the 10th International Conference on Insect Pests in Agriculture, 22-23 Octobre 2014, Montpellier, France.
18. Medjdoub-Bensaad, F. 2007. Etude bioécologique de la bruche de la fève *Bruchus rufimanus* (BOH) (Coleoptera: Bruchidae). Cycle biologique et diapause reproductrice dans la région de Tizi-Ouzou. Thèse de Doctorat en Sciences Biologique, U.M.MT.O. Université de Tizi-Ouzou, Tizi-Ouzou, Algeria, 126 pp.
19. Medjdoub-Bensaad, F., Khelil, M.A., and Huignard, J. 2007. Bioecology of broad bean bruchid *Bruchus rufimanus* Boh. (Coleoptera: Bruchidae) in a region of Kabylia in Algeria. Afric. J. Agric. Res. 2: 412-417.
20. Mezani, S. 2011. Bioécologie de la bruche de la fève *Bruchus rufimanus* (BOH) (Coleoptera: Bruchidae) dans des parcelles de variétés de fèves différentes et de fèveroles dans la région de Tizi Rached (Tizi Ouzou). Thèse en Sciences Biologiques U.M.MT.O., Université de Tizi-Ouzou, Tizi-Ouzou, Algeria, 81 pp.

21. Ministère de l'Agriculture. 2014. Rapport de la commission nationale d'évaluation de la production des légumineuses alimentaires, Tunisie, 50 pp.
22. Moalla-Abdennadher, N. 1997. Contribution à l'étude de la dynamique des populations de *Bruchus rufimanus* (Col. Bruchidae), insecte ravageur de la fève, *Vicia faba*. Mémoire de DEA. Faculté des Sciences de Tunis, Université Tunis El Manar, Tunisia, 82 pp.
23. Nasraoui, B. 1991. Principales maladies fongiques de trois légumineuses alimentaires dans la région du Kef (Tunisie). Tropicultura 9: 51-52.
24. Statsoft, 1998.Statistica 4.0 for Windows. Statsoft Inc., Tulsa, Oklahoma, USA.
25. Weigand, S. and Bishara, S.I. 1991. Status of insect pests of faba bean in the Mediterranean region and methods of control. In: Present status and future prospects of faba bean production and improvement in the Mediterranean countries, Cubero J.I. & Saxena M.C. (ed.), Zaragoza, CIHEAM, 1991. Options Méditerranéennes: Série A. Séminaires Méditerranéens 10: 67-74.
